patient's heart, said second predetermined subset being different from said first subset.

16. The apparatus of claim 15 wherein said set of electrodes comprises at least twenty-four electrodes.

17. A catheter assembly for mapping the interior of a patient's heart comprising:

d) a first set of electrode sites defining a first electrode array;

e) said electrode array adapted to be positioned within said patient's heart with a substantial number of said electrodes not in contact with said heart; and

f) a second set of electrode sites adapted to be located in contact with said patient's heart, said second set of electrode sites being different from said first set of electrode sites.

18. An endocardial mapping catheter assembly comprising:

g) a plurality of insulated wires braided throughout their length into an interlocking weave;

h) A distal portion of the interlocking weave being expandable from a first generally cylindrical shape to a second expanded shape; and

i) A plurality of electrodes on the insulated wires, each electrode in electrical communication with a single wire, and with each wire being in electrical communication with no more than a single electrode.

19. The endocardial mapping catheter assembly of claim 18 further comprising

d) an electrical plug on the proximal end of the interlocking weave, the electrical plug having a plurality of connections, each in electrical communication through one of the insulated wire to one of the electrodes.

20 The endocardial mapping catheter assembly of claim 18 further comprising a proximal non-expanding portion having a generally cylindrical shape.

21 The endocardial mapping catheter assembly of claim 20, wherein the proximal non-expanding portion is encapsulated in a biocompatible material.

22. The endocardial mapping catheter assembly of claim 21 wherein the biocompatible material is polyurethane.

23 The endocardial mapping catheter assembly of claim 21 wherein the distal expanding portion is not encapsulated in the biocompatible material.

24 The endocardial mapping catheter assembly of claim 18 wherein the second expanded shape is generally spherical.

25 The endocardial mapping catheter assembly of claim 18 wherein there are at least twenty-four electrodes.

26 The endocardial mapping catheter assembly of claim 18 further comprising an expandable balloon within the expandable distal portion of the wires.

27 An endocardial mapping catheter assembly comprising

j) an elongated flexible lead body having an interior lumen and proximal and distal ends;

k) at least twenty-four insulated wires in the lumen extending from the proximal to the distal end of the lead body, the wires collectively forming a wire assembly;

l) an expandable portion of the wire assembly near the distal end of the flexible lead body, the expandable portion being expandable from a first generally cylindrical shape to a second expanded shape;

m) the majority of wires in the wire assembly each having a single electrode in the expandable portion of the wire assembly;

n) an electrical plug on the proximal end of the flexible lead body, the electrical plug having a plurality of connection, each connection being in electrical communication with one of the wires.

28 The endocardial mapping catheter assembly of claim 27, wherein the electrodes are formed by removing a portion of the insulation surrounding the wire.

29 The endocardial mapping catheter assembly of claim 27 wherein the wire assembly is comprised by forming the insulated wires into a braid.

30 An endocardial mapping catheter assembly comprising:

o) a plurality of insulated wires surrounded by an insulating material,

p) a braid comprised of a combination of the insulated wires in an interlocking weave,

q) a flexible material surrounding a first portion of the braid, forming a flexible lead body, the flexible material not surrounding a second portion of the braid, forming an array, the array being deformable into a predictable geometric shape,

r) at least twenty-four electrodes on the braided wire array, each electrode in electronic communication with a single wire in the array.

31 The catheter assembly of claim 30 wherein the electrode is a gap in the insulating material surrounding the wire.

32 The catheter assembly of claim 30, wherein the flexible material is polyurethane.

33 The catheter assembly of claim 30, further comprising

e) an expandable balloon within the array.

34 The catheter assembly of claim 30, wherein the braid forms a lumen.

35 The catheter assembly of claim 34 further comprising a reference catheter in the lumen, the reference catheter having a tip electrode.

36 The catheter assembly of claim 35 wherein the reference catheter is movable relative to the braid within the lumen.

37 The catheter assembly of claim 36, further comprising

e) an electrical connector adapted for connection to an external monitoring device, the tip electrode of the reference catheter as well as each wire in the braid having an electrode being in electrical communication with a particular location on the electrical connector.

38 The catheter assembly of claim 30, further comprising

e) an electrical connector adapted for connection to an external monitoring device, each wire in the braid having an electrode being in electrical communication with a particular location on the electrical connector.

39 An endocardial chamber mapping system comprising:

s) a catheter assembly having
   i) an array of signal acquisition electrodes expandable from a substantially cylindrical shape to an expanded shape, and
   ii) a catheter plug with multiple connections, each of the connections being electrically coupled to a single electrode;

t) an interface apparatus having
   i) an interface plug adapted to be connected to the catheter plug to establish electrical connection to the electrodes,
   ii) a voltage acquisition apparatus in communication with the electrodes having an analog to digital converter, and
   iii) a signal generator in communication with the electrodes for generating low current pulses; and

u) a computer having
   i) electrical communication with the signal generator of the interface apparatus to control its function,
   ii) electrical communication with the voltage acquisition apparatus to receive the voltage acquired by the signal acquisition electrodes,
   iii) processing unit to compute the three-dimensional volumetric electric field distribution based on the signals received from the signal acquisition electrodes, and
   iv) a display showing the computed field distribution.

40 The endocardial chamber mapping system of claim 39, wherein the computer further comprises:

v) means for obtaining data relating to volume and shape of the endocardial chamber through the generation of low current pulses by the signal generator,

and wherein the display shows the obtained volume and shape of the endocardial chamber.

41 The endocardial chamber mapping system of claim 40 wherein the display shows the computed field distribution in a continuously filled color-scale map shown over the volume and shape of the endocardial chamber.

42 An endocardial chamber mapping system comprising:

v) a catheter assembly having
   i) an array signal acquisition electrodes expandable from a substantially cylindrical shape to a substantially spherical shape, and
   ii) an electrical connector plug with multiple connectors electrically coupled to the electrodes;

w) voltage acquisition apparatus in communication with the electrodes having an analog to digital converter; and

x) a computer having
   i) an electrical communication with the voltage acquisition apparatus to receive the voltage acquired by the signal acquisition electrodes,

ii) a processing unit capable of computing the three-dimensional volumetric electric field distribution based on the voltage at the signal acquisition electrodes, and

iii) a display for displaying the three-dimensional volumetric electric field distribution via an iso-potential map overlaid on a display of the heart geometry.

43 The system of claim 42 wherein the iso-potential map is displayed as a continuously filled color-scale map.

44 A method of constructing a mapping catheter comprising the steps of:

y) Forming a wire assembly of a plurality of wires, each wire running from a distal end to a connection in a proximal connector plug;

z) Selecting a wire;

aa) Forming an electrode on the distal end of the selected wire;

bb) Identifying the connection in the plug associated with the wire by applying an electric current to one of the electrode or connection, and detecting the current at the other of the electrode or connection; and

cc) Repeating steps b) through d) for additional wires.

45 A method of associating a connection in a plug on a mapping catheter with an electrode associated with a wire on the catheter, the method comprising the steps of:

dd) Applying an electrical signal to the connection;

ee) Detecting the electrical signal on the wire proximate the electrode; and

ff) Identifying the electrode associated with the connection.

46 A method of locating a catheter having a tip electrode in an endocardial cavity, the method comprising the steps of:

gg) positioning an electrode array within the endocardial cavity;

hh) positioning the catheter within the endocardial cavity;

ii) supplying an electric pulse to the tip electrode;

jj) receiving at the electrode array the voltage relating to the electric pulse;

kk) distinguishing the receive voltage relating to the electric pulse from any voltage relating to other electrical activity; and

ll) performing field theory calculations to determine the location of the tip electrode.

47 The method of claim 46 further comprising the step of displaying the position of the tip electrode.

48 The method of claim 47 further comprising the steps of calculating and displaying a map of electrical activity in the endocardial cavity and superimposing the location of the tip electrode on the map of electrical activity.

49 The method of claim 48 wherein the step of calculating the electrical activity in the endocardial cavity includes the substeps of:

i) determining volume and shape of the endocardial cavity;

ii) measuring electrical potentials on the electrode array relating to the electrical activity of the endocardial cavity;

iii) calculating the electrical activity of the endocardial cavity based upon the measured electric potentials and the volume and shape of the endocardial cavity.

50 A method of mapping a volumetric electrical potential distribution of a heart chamber arising from electrical activation in a myocardium comprising the steps of:

mm) positioning an electrode array within the heart chamber;

nn) determining heart chamber volume and shape;

oo) computing the position of said array within said heart chamber;

pp) measuring electrical potentials on said array;

qq) computing the three-dimensional volumetric electrical field distribution of said heart chamber volume from a spherical harmonic series expression containing said measured electrical potentials, and said array position; and

rr) displaying said volumetric electrical field distribution.

51 Software operating on a computer for mapping a volumetric electrical potential distribution of a heart chamber arising from electrical activation in a myocardium, the software comprising the following program elements:

ss) receiving first inputs relating the volume and shape of the heart chamber;

tt) computing the heart chamber volume and shape based upon the first inputs;

uu) receiving second inputs related to the position of an electrical array located within the heart chamber;

vv) computing the position of said array within said heart chamber based upon the second inputs;

ww) receiving third inputs relating directly to the electrical potentials received by electrodes on said array;

xx) computing from said third inputs the three-dimensional volumetric electrical field distribution of said heart chamber volume from a spherical harmonic series expression containing said measured electrical potentials, and said array position; and

yy) displaying said volumetric electrical field distribution.

Respectfully Submitted,
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